



Supracapsular implantation with optic capture of posterior chamber intraocular lens in Chinese children with aphakic after traumatic cataract

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Background: To assess the safety and efficacy of supracapsular implantation with optic capture of the posterior chamber intraocular lens in Chinese children with aphakic after traumatic cataract.

Methods: It was a retrospective case series study. Fifteen cases (15 eyes) Chinese children received supracapsular implantation with optic capture of the posterior chamber intraocular lens. Pre- and post-operative visual acuities were recorded. Intra- and post-operative complications were observed. The follow-up period ranged from 7 to 43 (28.7±7.2) months.

Results: Implantation of optic capture of the posterior chamber intraocular lens was successfully performed in 15 eyes. The best corrected visual acuity (BCVA) ranged from 0.3 to 1.0 (0.61±0.19). No optic axis opaque was found in 15 eyes with optic capture. The major complications of optic capture were iris posterior synechia and intraocular lens (IOL) precipitates. Intraocular dislocation was found in one case three weeks after the operation.

Conclusions: Supracapsular implantation with optic capture of the posterior chamber intraocular lens is safe and effective for the treatment of traumatic cataract in Chinese children.

Keywords: Post-cataract; aphakia; lens implantation; optic capture

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Introduction

Children are vulnerable to eye trauma. Traumatic cataract extraction and intraocular lens (IOL) implantation can effectively improve the postoperative visual acuity of the children (1). Because of the serious destruction of other ocular structures after trauma and actively proliferative response of children, IOL cannot be implanted at I stage operation after traumatic cataract extraction (2). With hyperplastic adhesion of anterior capsule and posterior

capsule, the capsular bag cannot be separated completely. Moreover, the injured capsule by trauma also increases the difficulty of the treatment. In addition, IOL implantations in children are easily to develop various complications, such as decentration of IOL, fibrinous uveitis, posterior capsule opacification (PCO), vitreous prolapse. These complications are much higher in traumatic cataract as the integrity of ocular structures is disturbed (3). In view of the above characteristics, we conducted this study. Supracapsular implantations with optic capture of the

posterior chamber intraocular lens were performed by the same ophthalmologist at the First Affiliated Hospital of Anhui Medical University. Satisfactory effects were achieved. The clinical data of children was analyzed retrospectively to evaluate the safety and efficacy of the surgery.

Methods

Subjects

From September 2012 to April 2014, 15 Chinese children with aphakia after traumatic cataract were performed supracapsular implantation with optic capture of the posterior chamber intraocular lens at the First Affiliated Hospital of Anhui Medical University. Among them, nine cases were male, six cases female, right eye eight cases, and left eye seven cases. Age varied from 5 to 12.5 years with an average of 8.5 ± 1.9 years. There were no other ocular diseases before trauma. The interval period between IOL implantation and cataract extraction varied from 3 to 25 (15.1 ± 4.8) months. Six cases were with intact posterior capsule, nine cases with posterior capsular rupture. Preoperative visual acuity without correction was from hand movement to 0.2. A/B ultrasound, corneal curvature and eye axial length measurement were done before the operation to determine the required IOL. The study protocol was reviewed and approved by Institutional Review Board. Informed consent was obtained from the parents of each child included in the study. Exclusion criteria were traumatic cataracts associated with large corneal laceration (10 mm or more) or laceration involving the visual axis, other obvious extensive ocular trauma that was likely to affect visual outcome consisting of angle recession, hyphema, posterior segment involvement, retinal detachment, and vitreous hemorrhage as detected on B-scan ultrasound. Children with systemic disorders included congenital rubella syndrome, galactosemia or any other ocular anomalies, such as: micro-ophthalmia, and microcornea.

Operation methods

All operations were performed by the same ophthalmologist. According to the patients' age and cooperation, selected general anesthesia or local anesthesia. Pupils were dilated routinely before operation, Tunnel incision and the corresponding Auxiliary incision were made, separated posterior adhesion of the iris and the membrane. Residual

Capsule and ciliary sulcus were fully exposed. If vitreous body prolapsed into the anterior chamber, anterior vitrectomy was performed. Posterior continuous curvilinear capsulorhexis was accomplished if posterior capsules were intact; if not, vitreous body in anterior chamber and anterior vitreous body were resected firstly. Then according to the original posterior capsular rupture, trimmed the posterior capsular rupture and made the position relative to the center with diameter of 3.5–4.0 mm. The appearance was round or oval. Anterior hyaloid membrane and anterior vitreous were resected. Supracapsular implantation with optic capture of the posterior chamber was accomplished. IOL haptics were positioned in the ciliary sulcus. Adjusted the position of the lens. IOL optical portion were surrounded and covered by capsular membrane at least 1 mm. IOL fixed without any sliding.

Power calculation

Corneal curvature and axial length readings were used for IOL power calculation. The IOL power was undercorrected in the anticipation of a myopic shift as the child ages and the eye grows (4). Children <2 years were undercorrected by 20%, between 2 and 5 years by 10%, 5–8 years by 5%, 8–10 years by 2.5%, and children older than 10 years were targeted for emmetropia (5).

IOL selection

Fourteen patients were implanted polymethyl methacrylate (PMMA) with Heparin treatment (Swedish Pharmacia Company), one patient was implanted with AcrySof (American Alcon Company).

Postoperative treatment

Tobramycin and dexamethasone eye drops were prescribed four times a day, dilated pupil with tropicamide. If fibrin exudation in anterior chamber or posterior iris adhesion was appearing, 1% atropine was added. According to the degree of anterior chamber reaction, intravenous infusion or subconjunctival injection of dexamethasone were performed.

Observation items

Data were collected and analyzed on the preoperative

and postoperative visual outcomes and complications. Uncorrected visual acuity and best-corrected visual acuity, intraocular pressure, color vision, vitreous and fundus examination, degree of anterior chamber exudation, lenticular precipitates [(according to Raina *et al.* (6) grading standards: grade 0: no precipitates, grade 1: occasionally visible precipitates, grade 2: less precipitates, grade 3: covered with precipitates)].

Results

Implantation of optic capture of the posterior chamber intraocular lens was successfully implemented in 15 eyes. Patients were followed up for 7–43 months with an average of 28.7 ± 7.2 months. The results were as follows.

Visual acuity and color vision inspections

Postoperative Day 1, 15 children had visual acuity ranging from 0.08 to 0.7 (0.31 ± 0.19), ≥ 0.5 four cases, ≤ 0.2 three cases. Patients were followed up for 7–43 (28.7 ± 7.2) months, and the best corrected visual acuity (BCVA) was 0.3–1.0 (0.61 ± 0.19), ≥ 0.5 nine cases. Color vision inspections were normal.

IOL and optical axis observations

No optic axis opaque was found in 15 eyes. Lenticular precipitates were as follows: ten cases were grade 0, three cases were grade 1, two cases were grade 2, and zero case was grade 3. Localized iris posterior adhesion was observed in 4 cases. There was no vitreous in anterior chamber and pupil area. No vitreous hyperplasia occurred. All posterior capsules were transparent and no optic axis opaque was found. Three patients with severe iris impairment complained of photophobia. An account in their own words, postoperative photophobia improved comparing with preoperative. No patients required laser posterior capsulotomy or anterior vitrectomy. Fourteen IOL were fixed at the centre of optic axis with haptics in ciliary sulcus. Optic capture was accomplished under the posterior capsule without slip or tilt. After 2 weeks follow-up, we found 1 IOL haptics (AcrySof, Alcon, America) prolapsing into the anterior chamber. An unfolded IOL was implanted instead of it. The optical part was scheduled the same as the others. The phenomenon no longer happened during the follow-up period and the BCVA was 1.0.

Lens capsule

Residual lens capsule in all patients covered IOL optical periphery without fracture and adhesion. Fibrous organizational membranes were visible in the capsule with the follow-up time of more than half a year.

Fundus and vitreous examination

No complications were observed during the follow-up period, such as cystoid macular edema, retinal detachment, and vitreous hemorrhage.

Intraocular pressure

First day postoperation, four patients were under 10 mmHg, 11 patients varied from 10 to 21 mmHg. There were no patients higher than 21 mmHg. Intraocular pressure was normal in all patients during the follow-up period.

Discussion

Ocular trauma is one of the main causes of monocular blindness. Children account for between 20% and 50% of all ocular injuries (7). Incidence of traumatic cataract in children is reported as high as 29% of all childhood cataract (8). Successful optical rehabilitation in the traumatic cataract cases depends upon experience of the surgeon, the choice of the surgical procedure, and the choice of IOL design (9–10). Opacification of the visual axis after pediatric cataract surgery is a serious complication. It is potentially induced by the proliferation and migration of the remaining lens epithelial cells (LEC) after surgery (11–13). IOL offer the advantages of compliance, minimal aniseikonia, and a predictable refractive result (14). IOL implantation after traumatic cataract extraction can effectively improve the postoperative visual acuity of children. The implantation mode selection was mainly based on the residual condition of the capsule. There are mainly three selections: (I) IOL capsule implantation; (II) IOL anterior capsule ciliary sulcus implantation; (III) IOL suture fixation. When the capsular bag was intact, the first operation mode could be accomplished. Although postoperative IOL position is relatively stable, occurrence rate of posterior capsular opacification is high. The rate is low for over 8 years old children who could cooperate with laser capsulotomy. When the capsule was not intact but with enough capsular supporting, the second operation mode

is the best choice. Despite with low rate of PCO, various complications frequently occurred, such as IOL dislocation, IOL capture, IOL decentration. IOL is prone to prolapsing into anterior chamber with serious iris injury. The third operation mode will produce serious surgical injury, severe uveal reaction and vitreous extrusion, which is prone to resulting in macular edema, retinal detachment and other complications. The operation usually was applied to patients without enough capsular supporting. The operation method of IOL optic capture was applied to congenital cataract in children by Koch *et al.* (11). The advantages were as follows: (I) to effectively prevent the occurrence of PCO, maintain visual axis transparent; (II) IOL position is relatively stable; (III) pupil capture rarely occurs because of supracapsular implantation and optic capture. But the application of this surgical approach in children with traumatic cataract is rarely reported. According to the characteristics of traumatic cataract, we conducted the supracapsular implantation with optic capture of posterior chamber intraocular lens in Chinese children with aphakic after traumatic cataract.

The operation can effectively prevent various complications of IOL implantation at two-stage operation with aphakic after traumatic cataract. First of all, if the capsular bag is not intact, supracapsular implantation with the use of remaining capsule can make IOL relatively fixed. Optic capture of the posterior chamber intraocular lens can prevent IOL prolapsing into the anterior chamber with iris atrophy or injury. Kumar *et al.* (12) found pupillary capture was the most common complication in children with monocular traumatic cataract. we did not find the complication during the follow-up period. Secondly, IOL optic capture can reduce the contact with iris, which will alleviate uveitis. Our conclusion was consistent with Vssavada (15). We did not find any serious uveitis and grade 3 lenticular precipitates. Uveal reaction decreasing to a certain extent can also reduce the risk of iris adhesion and pupillary capture. Last but not least IOL optical capture connecting between posterior capsular and anterior vitreous is not suitable for the LEC survival. Anterior vitreous plays an important role in the proliferation and migration of the LEC. Changes above all can effectively reduce the occurrence of PCO. No PCO was found in our research during the follow up. Supracapsular implantation with optic capture separated the anterior vitreous and anterior chamber. Reduction of vitreous prolapsing into anterior chamber can avoid many complications, such as corneal endothelial damage, high intraocular pressure, macular

cystoid edema, retinal detachment. Fibrous organizational membranes forming similar pupil structure or alternative iris can shield part of the light, which alleviate the photophobia in children with iris atrophy and injury.

Based on the variability of trauma and high requirement of ophthalmologist, especially for the posterior capsule is not intact, the design of operation is very important. Rupture assessment should be done to decide whether IOL can be implanted or not. If posterior capsular rupture range is too small to accomplish the optical capture, tear the posterior capsular and confirm the position in the middle of the circular about 3.5–4.5 mm in the diameter. If the rupture is large or irregular, rupture should be repaired. The expansion of the defect area of the capsular was done to make it centered and elliptical. The minimum diameter is smaller than the IOL optical part, the maximum diameter is less than the length of the IOL haptics. The haptics can be adjusted to any direction to make it have enough capsular support and accomplish the optical capture as ample as possible to increase the stability of the IOL. Because of the strong plasticity of the foldable IOL, IOL decentration will occur post-operation with the capsular bag contraction. The IOL curved and prolapsed into the anterior chamber during follow up period. Zhao *et al.* (16) reported the use of rigid IOL in the cases of congenital cataract. Therefore, It is appropriate to adopt the rigid IOL with large optical in order to reduce the incidence of IOL decentration.

To sum up, after supracapsular implantation with optic capture of the posterior chamber intraocular lens in Chinese school-age children with aphakic after traumatic cataract, the position of the IOL was stable, the optical axis was transparent, the visual acuity improved significantly postoperative. PCO and uveitis were effectively prevented. The operation process was safe and reliable. However, the long-term effect needs to be further observed.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/aes.2017.07.03>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all

aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Informed consent was waived due to the retrospective nature of the study. The study was approved by IRB of Anhui Medical University.

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